INNOVATION MEDIA

UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

PROSPERING THROUGH INNOVATION

Sustainable Wealth Creation

INNOVATION MEDIA

PROSPERING THROUGH INNOVATION
Sustainable Wealth Creation

by

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Contents

PREFACE

Organized by MINDS (Malaysian Invention & Design Society) since 1989, the annually organized The International Invention, Innovation & Technology Exhibition (ITEX) has changed the course showcasing modern and new technologies. The days of understated celebrations for the birth of an invention became something of the past. Gathering the world's most prolific inventors from Asia to Europe, ITEX provides a platform for such communities to flaunt their discoveries.

Attended by a plethora of invention from Malaysia and international researchers around the world. The ever increasing attention from the industry, business and entrepreneurs gives ITEX an extra edge. Thousands of what started as merely backyard inventions are today commercialized using the exposure platform from ITEX. These winning inventions stand to gain maximum recognition and to be on the launch pad to attract business opportunities.

ITEX presents an exciting opportunity for inventions to be showcased to potential business and investors both locally and internationally. The ITEX competition is open to all participating inventors to gain recognition for their inventions as well as to compete amongst other international inventors for local and international awards and medals.

UPM submitted a lot of new R&D and invention in all categories especially in Agriculture, Biotechnology, Health and Medicine, Building & Construction, Educational Items, Environmental & Renewable Energy, ICT & Multimedia and Industrial Design for the Invention Competition category during ITEX.

Since then UPM`s researcher gaining a lot of recognition, won a medals and also special awards from the various organization for the excellence and outstanding research products.

CHAPTER 1

AT THE FOREFRONT OF INNOVATION

As a premier institution of learning, widely recognized for leadership in research and innovation, UPM continues to strive for excellence. In order to motivate the entire university community towards achieving excellence, it ensures that all the members, both students and members of staff, share the responsibility of strictly adhering to the demands of the University's vision, mission and goals.

VISION

To become a university of international repute.

MISSION

To make meaningful contributions towards wealth creation, nation building and universal human advancement through the exploration and dissemination of knowledge.

GOALS

» Goal 1
Enhancing the Quality and Competitiveness of Graduates

» Goal 2
Creating Value through a Strong and Sustainable RDCE

» Goal 3
Boosting Industry and Community Networking Services

» Goal 4
Strengthening UPM as a Centre of Excellence in Agriculture

» Goal 5
Enhancing the Quality of Governance

AT THE FOREFRONT OF INNOVATION

PENCAPAIAN & PENGIKTIRAFAN

270th
QS World University Rankings

17th
QS Top 50 Under 50

REUTERS
TOP 75
Asia's Most Innovative Universities

PUTRA GLOBAL 200

49th
QS Asia University Rankings

34th
UI Green Metric University Rankings

5 STAR
QS Star Universities Ratings

89th
THE BRICS & Emerging Economics World Rankings

AGRICULTURE SCIENCE PROGRAM RANKINGS

TOP 100
QS World University Ranking by Subjects

42nd
US News & World Report

67th
National Taiwan University Ranking

MALAYSIA's TOP MOST INNOVATIVE UNIVERSITY

UI GreenMetric World University Ranking

UI-GREENMATIC WORLD UNIVERSITY RANKING 2016

1ST in Malaysia
2nd South East Asia
4th in Asia
34th in the World

TECHNOLOGY TRANSFER OFFICE

Putra Science Park (PSP) is the center for UPM innovation management or technology transfer office (TTO) for UPM that supports technology transfer activities in UPM by moving the potential technologies and research from the laboratory to the market.

PSP plays a vital role in helping secure and protect UPM's innovation through Intellectual Property protection and identifies appropriate strategies for commercialization of the Intellectual Property.

PSP also promotes potential of technologies through various channel such as publication, exhibition, showcase, press conferences and business matching programs with industry.
In addition, PSP also aims to develop an Incubation hub to nurture and develop technology entrepreneurship in the university.

UPM has more than 2000 patented R&D in Malaysia and worldwide in various field of research. Now we looking a partner from industries (company /entrepreneur /angel investor) to collaborate with us for commercialised out UPM R&D to become a products that can benefit the industry, public or nation building.

UPM PSP is also a member of the Innovation Technology Managers Association (ITMA) since 2014.

INDUSTRY

PSP works with researchers to attract corporate partners from industries that can bring inventions and discoveries to the marketplace through technology licensing agreements.

Until now, many products derived from UPM technologies have been manufactured and commercialised by the industry.

Technology licensing agreements promote the development and commercialization of UPM technologies by granting rights to commercialise such technologies to companies in return for agreeable licensing fee, royalties, equity and other fees.

PSP will assist throughout the agreement process.

UPM AT ITEX 2017

UPM showcase new invention
at ITEX 2017

DATE
11 - 13 May 2017

TIME
9.00 am - 6.00 pm

VENUE
Kuala Lumpur Convention Centre, Malaysia

ITEX FOCUS

Attracts the right target group in the science and technology industry. Investors, venture capitalists, manufacturers, entrepreneurs, distributors and the corporate sectors make their way to ITEX specifically to explore new business ventures. ITEX is the best place to unveil a new invention or product.

The industry's keenest are here to discuss and debate research work. Fellow inventors and researchers will be delighted with the level of academic discussion enabled here.

ITEX is where commercialisation of inventions/new products happens. Inventors can seek out potential investors here and convince them why funding their invention can benefit society.

ITEX provides the best audience for prototype inventions or products. Get feedback from investors and fine-tune to achieve successful commercialisation.

ITEX PARTICIPANTS

Inventors and Researchers
Scientist and Technologists
Intellectual Property Support Services
Corporate Sectors
Small Medium Industries (SMIs)
Small Medium Enterprises (SMEs)

TARGETED VISITOR

Venture Capitalists
Investors
Manufacturers
Industry Specifiers
Inventors and Researchers
Scientist and Technologists
Industrial Designers

CATEGORIES

Aerospace and Aviation
Agriculture
Apparel, Fabric and Garment
Audio-Visual Equipment
Automotive and Transportation
Biotechnology, Health and Fitness
Building and Construction
Chemicals
Educational Items
Electricity / Electronics
Environmental and Renewable Energy
Household Items
ICT and Multimedia
Industrial Design
Machines and Equipment
Manufacturing Process
Materials
Office Products
Personal-Care Products
Printing and Packaging
Special Care and Child Care
Sports and Games
Telecommunications

CHAPTER 3

INNOVATION COMPETITION

ITEX INVENTION & DESIGN COMPETITION

The International Invention, Innovation & Technology Exhibition (ITEX) presents an exciting opportunity for inventions to be showcased to potential business and investors both locally and internationally. The ITEX competition is open to all participating inventors to gain recognition for their inventions as well as to compete amongst other international inventors for local and international awards and medals.

ITEX is a showcase of the region's best inventions from Asia and Europe, with participants coming from over 20 countries.

An annual exhibition, ITEX features 23 invention categories related to innovation or technology which aim to make everyday life easier. One of the most prominent features at ITEX is the Invention and Design Competition where local and international Awards will be bestowed to successful inventors.

A stellar line-up of 1,000 inventions by local and international inventors, research scientists, research institutions, individual inventors, young inventors and corporations will be showcased. All of the exhibitors will be putting their best foot forward to vie for investors' attention. Those who stand out will be on their way to commercialise their inventions.

The exhibition will culminate in the Celebration of Creativity Banquet (Malam Budaya Cipta) with prestigious local and international accolades and awards being presented.

This competition is open to all participants of ITEX in the following categories:

- Universities/Educational Institutions
- Research Institutions
- Corporates
- Startups
- Overseas
- Individuals

All participating inventions vie for the gold, silver or bronze ITEX medals. In addition, they will also be in contention for special awards, international awards and the Best Inventor of the Year Awards.

The organisation with the highest number of gold medals will be awarded with the Patron Award by the Ministry of Science, Technology and Innovation.

The highlight of the awards is the most prestigious Asian Invention Excellence Award which will be awarded to the very top invention amongst all the inventions in the exhibition.

ITEX MALAYSIA INNOVATIVE PRODUCT AWARD COMPETITION

The ITEX Malaysia Innovative Product Award (MIPA) recognises the outstanding inventions or products that have been successfully commercialised within the past 12 months.

This competition is open to all participants of ITEX with inventions that have been recently commercialised and the Best Innovative Product Award will be awarded to the best product amongst MIPA participants.

ITEX & INTERNATIONAL AWARDS

ITEX Awards
Patron Award By MOSTI
Asian Invention Excellence Awards
IFIA Award
Malaysia Innovative Product Award
Sponsor Awards
International Awards

JUDGING PROCESS

START

2 judges will be assigned to judge each invention
Arrival and greetings
Judges introduce themselves and verify Booth Tag details
Proceed with 15 minutes explanation
Judges sign on Booth Tag

JUDGING ENDS

JUDGING CRITERIA

Criterion 1 Novelty and inventiveness
(new, original, creative, unique)

Criterion 2 Usefulness and application
(solving problem and contribution to industry)

Criterion 3 Presentation and demonstration
(able to demonstrate knowledge, functionality and product readiness)

Criterion 4 Market and commercial potential
(market spread, affordability, product market life span)

Criterion 5 Environmental Friendliness
(RoHS compliant, recyclable, reusable, renewable)

TIPS AND ADVICE

1. Be at booth at all times during the judging period.
2. Make sure that the Team Leader or the person who is going to present is available.
3. Be very conscious of the time. Rehearse presentation and clock it.
4. Check and confirm the entry details. Inform the Secretariat directly if there is any change.
5. Focus on invention. It is unwise to make guesses on the judge's style or personality.
6. Highlight invention's uniqueness, especially if there are other similar products in existence in the market.
7. Giving samples and souvenirs to judges are not encouraged.

CHAPTER 4

COMMERCIALISATION OF R&D

TECHNOLOGY COMMERCIALISATION

UPM has produced many researchers in the field of innovation and technology in the past few years. Through them, UPM has successfully delivered many technologies beneficial to the community for nation building. In recent years, our research activity has experienced extremely strong growth.

As of 2016, a total of 134 technologies commercialised to our partners and industry players, with a gross sale of more than RM58 million. We are delighted to engage and to work together with our potential industry partners. Please do not hesitate to contact our team for further information.

We look forward to continuing success and collaboration. UPM has more than 2,000 inventions that are available for licensing in various fields.

UPM INDUSTRY COLLABORATION

PSP strongly believes in the benefits and importance of technology transfer in commercialising UPM`s technologies and encourages research collaborations with industry nationally and internationally.

PSP initiates and conducts interactions, presentations and negotiations with various industries on behalf of UPM with the involvement of researchers. It is PSP`s mission to transfer technologies from the lab to the market that would benefit the society.

MODE OF COMMERCIALISATION
UPM - Company

1) Licensing of Technology (patent/ industrial design/ copyright/ know-how)

– Type of Licensing : Exclusive, Non-exclusive

– Fees include : Licensing fee – Royalty – Other benefits

2) Assignment of IP (selling out UPM IP rights)

visit UPM patented technologies at

www.sciencepark.upm.edu.my
www.upmip.edu.my

CHAPTER 5

INNOVATION DIRECTORY

WITH KNOWLEDGE WE SERVE

PSP strongly believes in the benefits and importance of technology transfer in commercialising UPM`s technologies and encourages research collaborations with industry nationally and internationally.

PSP initiates and conducts interactions, presentations and negotiations with various industries on behalf of UPM with involvement of researchers. It is PSP`s mission to transfer technologies from the lab to the market that would benefit the society.

For ITEX 2017, UPM displayed 9 new technologies in various fields.

ITEX '17 MALAYSIA
28TH INTERNATIONAL INVENTION & INNOVATION EXHIBITION
11 - 13 MAY 2017 | KUALA LUMPUR CONVENTION CENTRE, MALAYSIA

LIST OF UPM INNOVATION DIRECTORY FOR ITEX 2017

No.	Innovation	Project Leader	Faculty
1.	Improving Energy Consumption in Cloud Computing Data Centre	Assoc. Prof. Dr. Syed Abdul Rahman Al-Haddad Syed Mohamed	Engineering
2.	Highly Sensitive Ammonia Sensor Using Tapered Optical Fiber Coated with Zinc Oxide Nanostructures	Dr. Mohd Hanif Yaacob	Engineering
3.	Green Plastic: Jatropha Oil-Plasticized Poly(lactic acid)	Assoc.Prof. Dr. Nor Azowa Ibrahim	Science
4.	Preparation of Carbon Quantum Dots	Assoc.Prof. Dr. Suraya Abd Rashid	Advanced Technology (ITMA)
5.	Nanocapsules Phase Change Materials	Prof. Dr. Mohd Zobir Hussein	Advanced Technology (ITMA)
6.	ECO-ZYME: Microbial Enzyme for Quality Kenaf Fibers	Assoc. Prof Dr. Wan Zuhainis Saad	Biotechnology & Biomolecular Sciences
7.	Safe and Premium Tocotrienol-Carotenoid Rich Functional Cosmeceutical Products for Eczema Patients	Prof Dr. Lai Oi Ming	Biotechnology & Biomolecular Sciences
8.	Cellulosimicrobium cellulans culture to degrade oil pollution	Dr. Normala Halimoon	Environmental Studies
9.	Program Celik Bahasa Kebangsaan	Assoc.Prof. Dr. Vijayaletchumy Subramaniam	Modern Languages and Communication

INNOVATION DIRECTORY

PROSPERING THROUGH
INNOVATION

ENEFDA- Improving Energy Consumption in Cloud Computing Datacenter

Need

According to the 2016 EPA's report on datacenter energy, 40% of all datacenter power consumption and 80% of the total IT load power consumption are consumed by servers, and these percentages are increasing with the popularity increase of cloud computing technology utilized by big companies such as eBay, Facebook, Yahoo, and Google. Besides consuming massive amounts of energy, a huge amount of CO2 emission can be produced. As a result, these companies have been looking for solutions to reduce the energy consumption without affecting on the quality of the cloud services they are offered to their customers.

Approach

A novel *DNA based Fuzzy Genetic scheduling algorithm* (DFGA) for cloud computing datacenters to maximize the resource utilization ratio and hence, reduce the energy consumption (refer to image).

Benefit

Enhancing Cloud computing datacenetrs energy-aware efficiency based approaches (refer to table)

- Maximize the resource utilization ratio.
- Minmize the number of VM migration.
- Reduce the energy consumption.

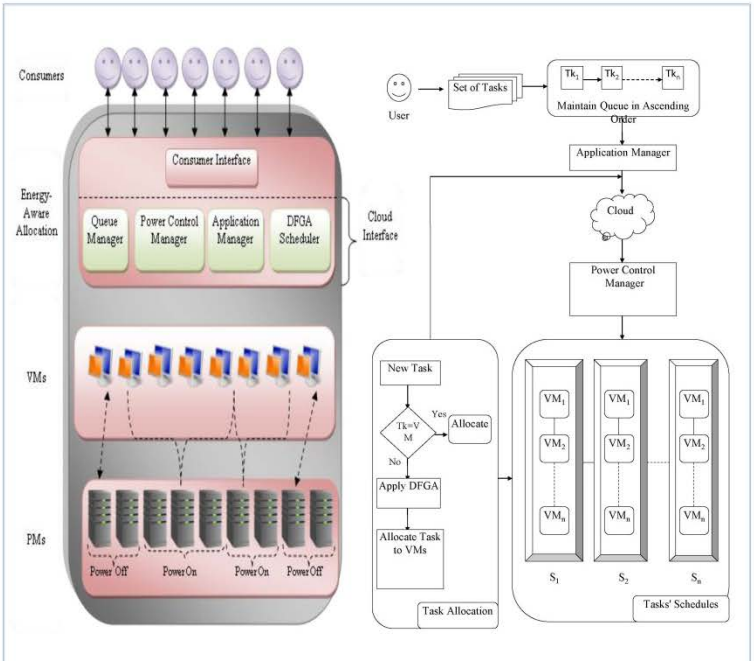
Metric / Algorithm	ΔP_{total}	EC/RU	RU (%)	VMM(X1000)	$1.4 m \year $0.10 kWh 12.583 server
DFGA (Proposed Method)	***2.15***	***3.12***	***82%***	***2***	***30 % ≈ $400000***
EARH	2.55	4.95	72.8%	3.2	22% ≈ $298400
NRHEARH	2.68	6.83	65.6%	4.8	17.6% ≈ $242240
NMEARH	3.28	8.28	43.5%	-	6.7% ≈ $83040
NRHMEARH	3.87	10.21	39.8%	-	2.7% ≈ $28160
MBFD & MM	2.65	5.98	70%	5	18.2% ≈ $255200

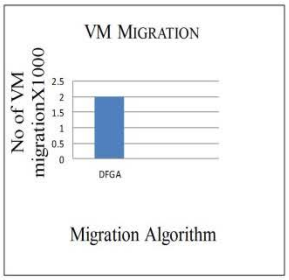
Market Potential

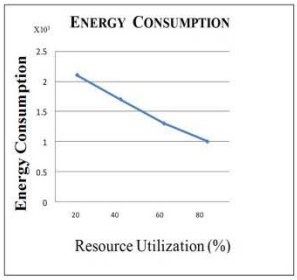
- Big Data and IoT Industries
- Smart Cities
- Cloud, Grid, Distributed Computing Companies and Organizations such as Google, Yahoo, Amazon, and e-pay.

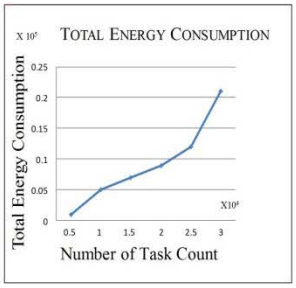
Project Leader : Assoc. Prof. Dr. Syed Abdul Rahman Al-Haddad Syed Mohamed
Co-Researchers : Sura Khalil Abd; Dr. Fazirulhisyam Hashim; Dr. Azizol Abdullah; Assoc. Prof. Dr. Salman Yussof; Dr.Mustafa Musa
Faculty : Engineering
Email : sar@upm.my
Phone : +603-8946 6440
Expertise : Cloud computing, Networking, Human Sound Processing, Animal Sound Processing, Quran Sound Processing

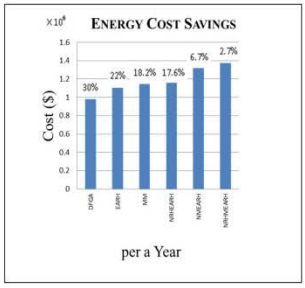
ENEFDA- Improving Energy Consumption in Cloud Computing Datacenter











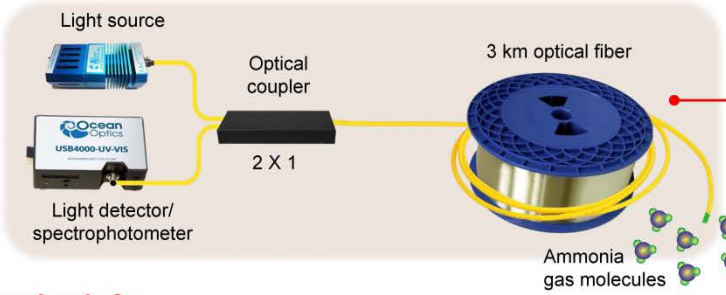
Project Leader : Assoc. Prof. Dr. Syed Abdul Rahman Al-Haddad Syed Mohamed
Co-Researchers : Sura Khalil Abd; Dr. Fazirulhisyam Hashim; Dr. Azizol Abdullah; Assoc. Prof. Dr. Salman Yussof; Dr.Mustafa Musa
Faculty : Engineering
Email : sar@upm.my
Phone : +603-8946 6440
Expertise : Cloud computing, Networking, Human Sound Processing, Animal Sound Processing, Quran Sound Processing

AMMONIA GAS SENSOR USING TAPERED OPTICAL FIBER COATED WITH ZINC OXIDE NANOSTRUCTURES

PATENT NO. PI 2016700567

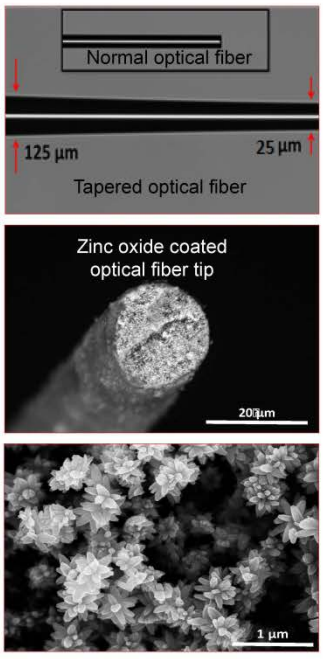
Invention

Remote ammonia optical sensor



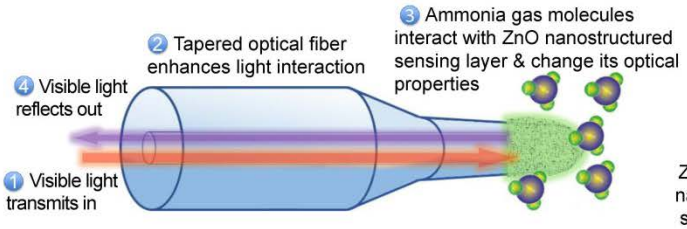
Prototype

Tapered optical fiber coated with zinc oxide nanostructures



Principle

Combining light and nanotechnology, ammonia (NH_3) sensor was developed by integrating tapered ('modified') optical fiber with zinc oxide (ZnO) nanostructures as the gas sensing layer.



Project Leader : Dr. Mohd Hanif Yaacob
Co-Researchers : Dr. Arafat Shabaneh, Ahmed Lateef Khalaf, Dr. Zuraidah Zan, Dr. Suriati Paiman, Prof. Dr. Mohd Adzir Mahd
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Expertise : Optical Nanomaterials, Sensors and Communications

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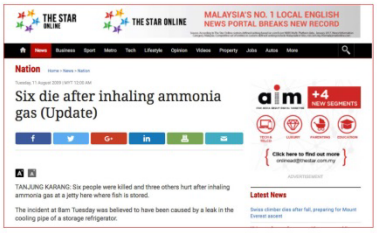
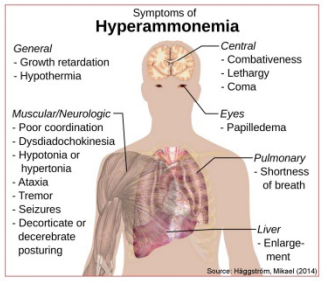
AMMONIA GAS SENSOR USING TAPERED OPTICAL FIBER COATED WITH ZINC OXIDE NANOSTRUCTURES

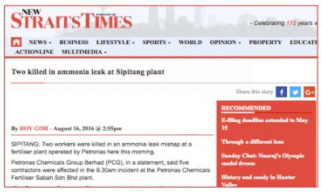
PATENT NO. PI 2016700567

Need

Ammonia is widely used gas with a strong smell and high toxicity. The inhalation of this gas is deadly. Many fatal accidents are reported annually due to the ammonia leakages.

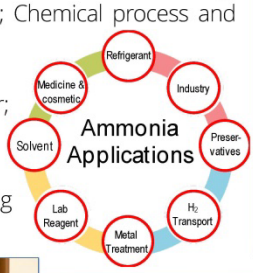


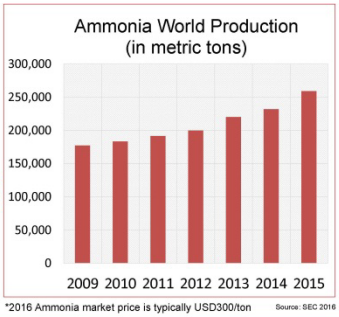




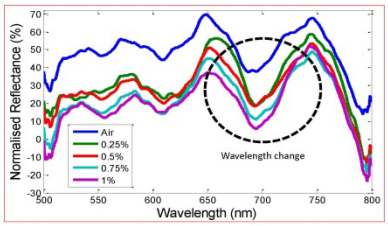
Market Potential

Remote environmental monitoring; Oil and gas; Chemical process and logistic; Agriculture and fertilizer; Pharma-ceuticals and cleaning industries.



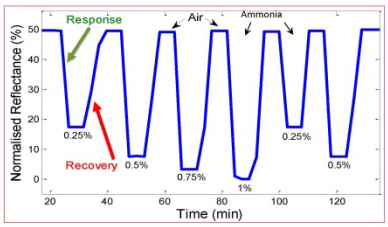


Ammonia Optical Sensor Response



Tapered optical fiber sensor changes its intensity (reflectance) proportionally when exposed to different ammonia concentrations.

High surface area of ZnO nanostructures improves molecules interaction. Very fast response (60 s) and recovery (70 s) achieved at low temperature for remote optical fiber cable (3 km).



Advantages & Strengths

Lightweight; Immune to electromagnetic interference (EMI); Suitable for volatile & flammable environment; Suitable for remote monitoring system (approx. 3 km); Room temperature operation; Energy saving; Competitive cost; High sensitivity and selectivity; Fast response and recovery (<one minute).

Competitor Technology

Localised electrical sensor; Prone to EMI; Poor selectivity; High operating temperature (100 - 300°C); Limited environment.

Project Leader : Dr. Mohd Hanif Yaacob
Co-Researchers : Dr. Arafat Shabaneh, Ahmed Lateef Khalaf, Dr. Zuraidah Zan, Dr. Suriati Paiman, Prof. Dr. Mohd Adzir Mahd
Faculty : WiPNet, Faculty of Engineering, Universiti Putra Malaysia (UPM)
Email : hanif@upm.edu.my
Phone : +603-89466454
Expertise : Optical Nanomaterials, Sensors and Communications

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GREEN PLASTIC: JATROPHA OIL-PLASTICIZED POLY(LACTIC ACID)

PATENT NO. PI2016700772

Need

- Growing market demand for green products has placed pressure on manufacturers and supplier to find alternatives for petroleum-based plastics.
- Fluctuations in the prices of petroleum, forcing the companies to search for a stable source of raw material.
- The government in the country has also been encouraging the usage of bioplastics in the country, with some local governments making laws to ban the usage of non-bioplastics in the retail shops.
- Biodegradable poly(lactic acid) PLA offers a possible alternative to the petroleum-based polymers. However, the inherent brittleness have limited its wider applications.

Approach

We have focused on plant-based and non-edible oil (Jatropha curcas) for PLA plasticization. Jatropha oil with higher content of linoleic acid (C18:2) compared to palm oil and soybean oil thus gives higher percentage of oxirane content upon epoxidation process which lead to better plasticization effect. Use existing equipment for plastic processing.

Benefit

EJO is epoxidized derivative of jatropha oil which content high amount of oxirane content (4 – 6 %) compared to other edible oils such as palm oil and soybean oil. This plasticizer is biodegradable, non-volatile, non-toxic and exhibits no or minimum leaching or migration during use or aging. EJO significantly improved flexibility property of poly(lactic acid). In addition improved the thermal stability. The products and the processing methods are green.

Polymer (ASTM D638)	Tensile Strength (MPa)	Elongation at Break (%)	Tensile Modulus (MPa)
PP	36	150	1300
LDPE	12	515	285
HDPE	28	500	800
PET	55	70	2700
PC	70	100	2400
PLA	60	5	1500
PLA/EPO (our research)	32	114	942
PLA/ESO (our research)	37	220	919
PLA/EJO (this invention)	43	388	815

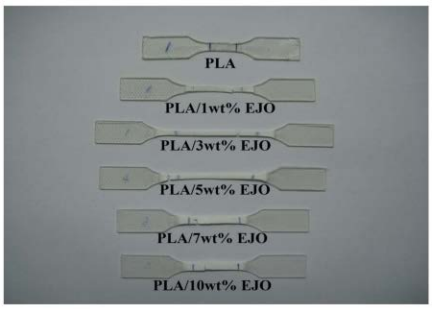
Competitor/Market Potential

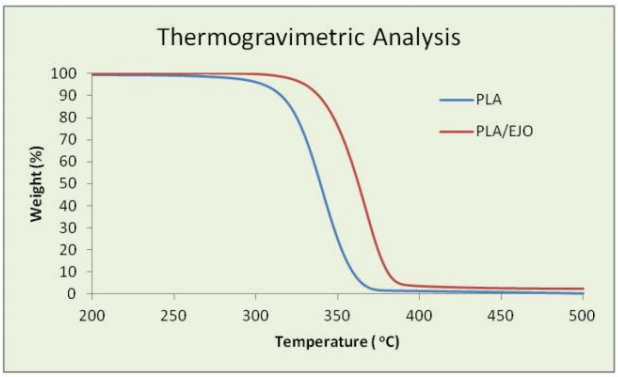
- The material has many possible uses in the manufacture of automotive component, consumer goods, product packaging and agricultural goods.
- The bioplastics & biopolymers market is projected to witness a CAGR of 12.0% from 2016 to reach a market size of USD 5.08 billion by 2021.
- Incorporating bioplastics into products will allow manufacturers to meet current and upcoming regulatory requirements for sustainable content. These businesses will also find it easier to qualify for the Government Green Procurement (GGP) scheme and gain access to valuable export markets.

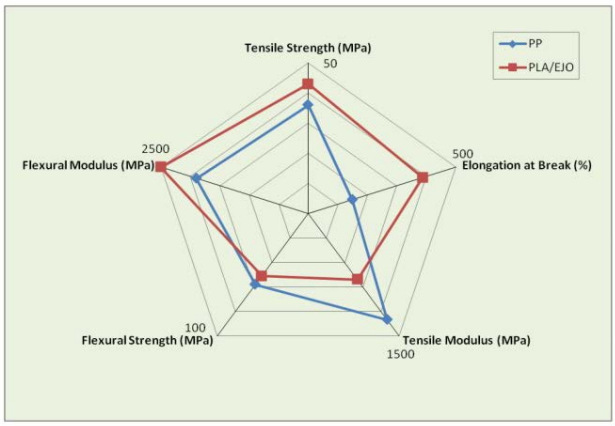
Project Leader : Assoc. Prof. Dr. Nor Azowa Ibrahim
Co-Researchers : Dr. Chieng Buong Woei
Faculty : Science
Email : norazowa@upm.edu.my
Phone : 03-8946 6802
Expertise : Polymer Chemistry, Material Science

GREEN PLASTIC: JATROPHA OIL-PLASTICIZED POLY(LACTIC ACID)

PATENT NO. PI2016700772







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PHOTOLUMINESCENT CARBON QUANTUM DOTS DERIVED FROM BIOCHAR VIA A GREEN SUBCRITICAL HYDROTHERMAL METHOD

PI2016703467

Need

Carbon Quantum Dots (CQD) are nanosized fragments of carbon nanomaterials, with sizes typically less than 10nm. Being zero dimensional nanostructure, they have high surface area and posses unique electrical and optical properties rendering them photoluminescent. An innovative approach has been developed to replace the conventional top-down synthesis of CQD which commonly use techniques involving harsh acids and oxidation agents followed by neutralization and dialysis steps.

Approach

- Exfoliation of graphitized biochar.
- Synthesis of CQD from biochar using an acid-free hydrothermal approach.
- Different types of biochar and reaction temperature were investigated.

Benefit

CQDs are non-toxic carbon nanostructures	Raw materials used are abundant and sustainable
Photoluminescent CQD	
Subcritical hydrothermal method is a green, acid free process and scalable technology	Safe to be applied in various applications due to nontoxic nature of carbon

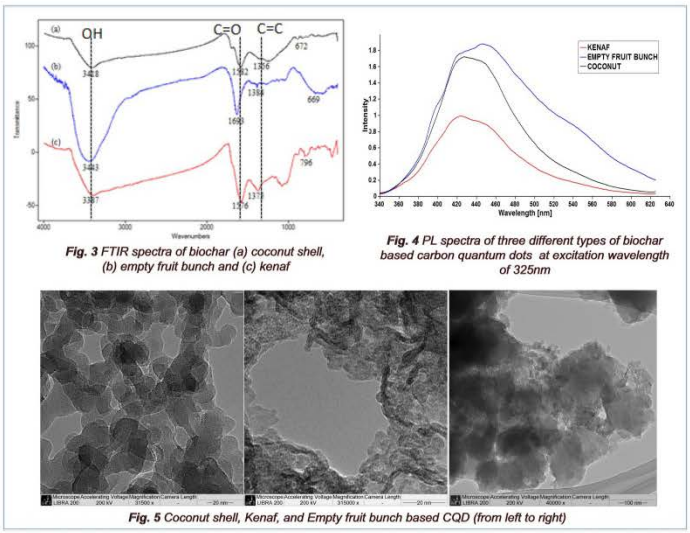

Fig. 3 FTIR spectra of biochar (a) coconut shell, (b) empty fruit bunch and (c) kenaf

Fig. 4 PL spectra of three different types of biochar based carbon quantum dots at excitation wavelength of 325nm

Fig. 5 Coconut shell, Kenaf, and Empty fruit bunch based CQD (from left to right)

Competitor/market potential

- Current innovative technology able to minimize the long processing time and avoid the usage of harsh chemicals which is used in conventional top-down approach
- Easy production and eco-friendly approach

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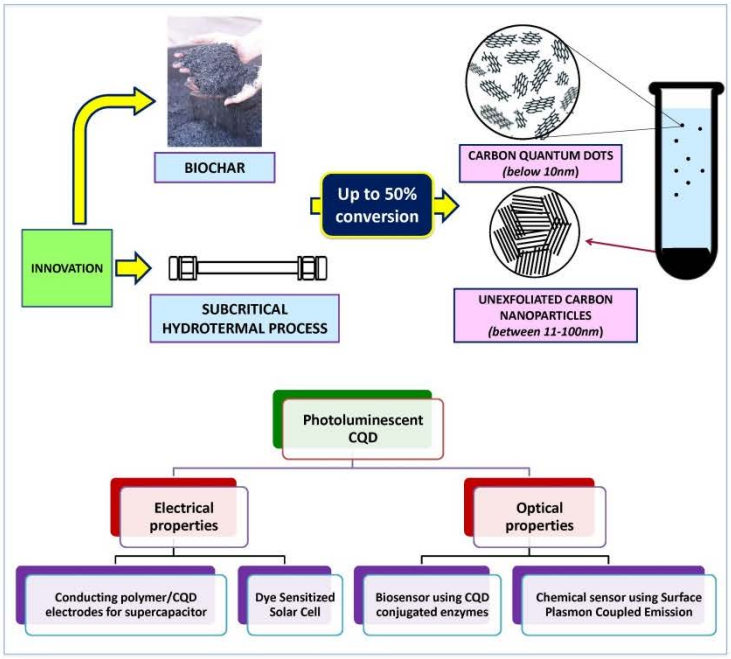
PHOTOLUMINESCENT CARBON QUANTUM DOTS DERIVED FROM BIOCHAR VIA A GREEN SUBCRITICAL HYDROTHERMAL METHOD

PI2016703467



Photoluminescence of CQD under UV-Light Source Derived From Different Types of Biochar

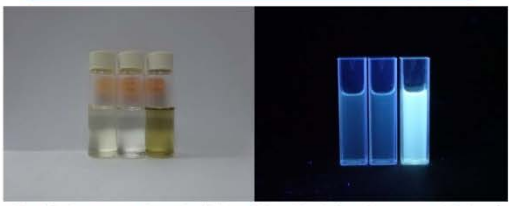


Fig. 1 Carbon quantum dots under UV-lamp 365nm. From left to right; coconut shells, kenaf and empty fruit bunch

Effect of Temperature on Photoluminescence of CQD under UV-Light Source

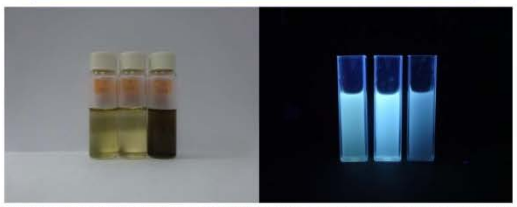


Fig. 2 Carbon quantum dots from EFB under UV-lamp 365nm at different temperature. From left to right; 250°C, 300°C and 350°C

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NANOPCM GYPSUM COMPOSITE BOARD AS A SMART THERMAL ENERGY STORAGE FOR BUILDING

PATENT NO. PI2015000037

Need

Buildings are responsible for 40% of the total world annual energy consumption, in which the large portion of energy is used for heating and cooling purposes. In addition, it is also responsible for green gas emission and depletion of conventional energy resources. Therefore, it is a great demand to develop building materials with improving energy efficiency, and at the same time has a capability to maintain the internal building comfort temperature, thus reduce the energy usage and indirectly could protect the environment from CO_2 emission.

Approach

- Incorporation of nanoPCM into gyspsum for the fabrication of a NanoPCM gypsum composite board (NGCB) which can act as a smart passive thermal energy storage.
- The NGCB obtained has the ability to release, store and absorb thermal energy automatically depending on the surrounding temperature.
- This property could maintain the building comfort temperature by reducing the internal building temperature fluctuation, thus indirectly will reduce the energy usage.

Benefit

(i) Simple production method and easy to up-scale; (ii) The technology is currently not commercially available in Malaysia; (iii) The nanoPCM for thermal energy storage is superior compared to the commercially available microcapsules; more efficient heat transfer and more compatible with building material (iv) non-hazardous.

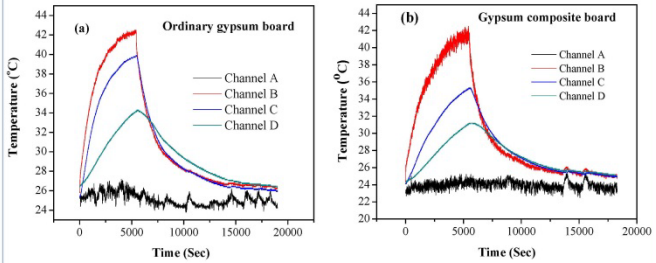

Fig. 6 Temperature profiles of (a) ordinary gypsum board and (b) gypsum composite board containing 5 % NanoPCM (Channel A: Laboratory environment; Channel B: external surface of the gypsum boards (outside wall); Channel C: inside wall of the gypsum board; Channel D: Indoors (center of the test room)

✓ NanoPCM has a capability to reduce the energy consumption by decreasing the indoor building temperature variation.

Competitor/Market Potential

- The product has a great potential to be marketed all around the world as a component for comfort, green building materials, especially for countries with extreme climate.
- Consumers consciousness about the energy-saving and environmental-friendly energy technology is a driving force for the growth of the global PCM market.
- The PCM market is estimated to grow from USD 460 million in 2013 to USD 1150 million by 2018 (source:http://www.marketsandmarkets.com)

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NANOPCM GYPSUM COMPOSITE BOARD AS A SMART THERMAL ENERGY STORAGE FOR BUILDING

PATENT NO. PI2015000037

Fig. 1 NanoPCM

Fig. 2 NanoPCM gypsum composite board

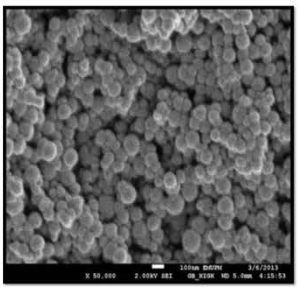

Fig. 3 FESEM image of NanoPCM

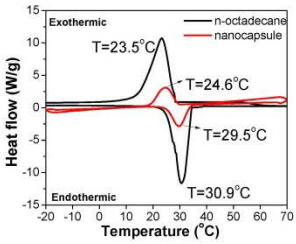

Fig. 4 DSC thermograms of NanoPCM

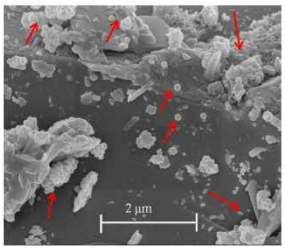

Fig. 5 FESEM image of a crushed NanoPCM gypsum composite board (arrow shows the NanoPCMs are still intact)

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ECO-ZYME: MICROBIAL ENZYME FOR QUALITY KENAF FIBRES

PI 2015704420

Need

This technology was developed as a collective effort to help our country's policies to make Kenaf as our 3rd commodity plantation right after Palm Oil and Rubber. Eco-Zyme offers its potential in kenaf retting process to produce high-quality kenaf fibres in much shorter period that is from 3 week to 3 days.

Approach

- The name of this product is Eco-Zyme.
- It is an enzyme that was extracted from our locally isolated microbes to help in the proses of kenaf retting in order to obtain kenaf fibres.
- Eco-zyme is produced using very low- cost substrates and media composition but able to produce high activity enzyme.

Features	Water retting	Dew retting	Mechanical retting	Microbial retting	Eco-zyme
Cost	Low	Low	Low	High	High
Performance	Non-specific	Non-specific	Non-specific	Non-specific	Specific
Time	Long	Long	Short	Moderate	Short
Quality	Good (Vary)	Moderate (Vary)	Poor	Good	High
Pollution	Yes	Yes	No	Yes	No

Kenaf fibre treated with Eco-Zyme at different time

Market Potential

Benefit

- Shorten the retting time
- Specific performance
- No bad odour
- Environmental-friendly

Potential Customer

- Fibres Manufacturer
- Kenaf Farmers
- Fibre-Based Product Companies

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ECO-ZYME: MICROBIAL ENZYME FOR QUALITY KENAF FIBRES

PI 2015704420

Eco-Zyme

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PROSPERING THROUGH INNOVATION

NATURAL, PRESERVATIVE-FREE PALM-BASED ANTI INFLAMMATORY LIPID BIOACTIVES SKIN FORMULA FOR FOR ECZEMA PATIENTS

PATENT NO. MY-158177-A (PATENT GRANTED 6/9/16)

Need

- Consumers nowadays are inclined towards cosmetics products formulated from natural ingredients, no harsh ingredients.
- 20% of the Malaysian population afflicted by eczema or atopic dermatitis conditions.
- No cure for eczema
- Steroid-based cream can be damaging (long-term use)
- Skin may develop permanent stretch marks, brushing, discoloration, or thin spidery blood vessels which can lead to skin cancer.

Approach

- Formulated with full spectrum vitamin E (α,β,γ,δ tocotrienol and tocopherol) complementing with other ingredients in a balance blend to repair despaired skin conditions.
- The ingredients have been proven clinically to calm itching and burning quickly.
- Natural source for anti-oxidant and anti-inflammatory actions.
- Standardized processing conditions to turn ingredients to nano-size range to optimize the absorption to dermis layer.

Benefit

Preliminary studies showed very significant results. RemediiXZMA was able to reduce the symptoms of psoriasis and eczema effectively. Other than its efficacy, the product concept covers critical aspects of production including sourcing of Halal ingredients and usage of permissible substances. All products in the range of REMEDII, including RemediiXZMA was controlled by a strict protocol and experimental based study to ensure that the ingredients selected and the way they are processed are permitted or lawful in Islam.

Results on Eczema and Psoriasis Patients

a) Ella, a 8-years-old Filipino girl literally abandoned for 3 years despite her having serious eczema on all over the body. Her conditions is significantly improved after 6 months of treatment

b) Faiz, a 46-years-old TNB senior engineer diagnosed with psoriasis. After 4 months of treatment with RemediiXZMA, the lichenified layer and itchiness on both legs has been significantly reduced.

Competitor/Market Potential

- No products utilizing red palm olein as a cosmeceutical functional ingredient.
- Similar products: herbal antioxidants, virgin coconut oil, and vitamin E (tocopherol)
- Concentrated tocotrienol powder by Gold Tri-E by Sime Darby is RM1500/kg

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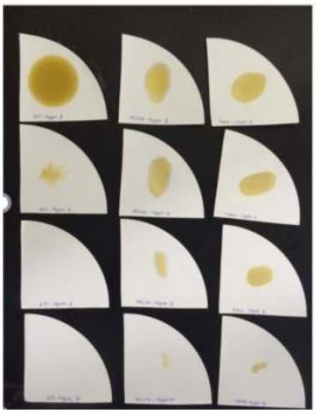
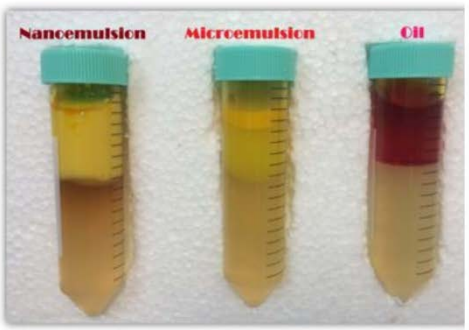
NATURAL, PRESERVATIVE-FREE PALM-BASED ANTI INFLAMMATORY LIPID BIOACTIVES SKIN FORMULA FOR FOR ECZEMA PATIENTS

PATENT NO. MY-158177-A (PATENT GRANTED 6/9/16)

Improved Penetration of Bioactive



oil Micro-sized Nano-sized



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CELLULOSIMICROBIUM CELLULANS CULTURE TO DEGRADE OIL POLLUTION

PATENT NO. PI2016704458

Need

Petroleum hydrocarbons polluted sea water by enter the marine environment as oil spills through pollution from ports including shipping accidents and terrestial discharge such as sewage treatment systems and natural oil seepages. The oil disintegrates into slicks losing its volatile hydrocarbon fractions to form tar balls by aggregates with debris. The oil hydrocarbons need to clean-up from polluted to aquatic ecosystem in marine environment.

Approach

- The present invention of isolated *Cellulosimicrobium cellulans* strain from tar ball can be degraded individual diesel oil alkanes between 10 to 95.4%.
- This shows the bacteria strain was able to degrade diesel-oil alkanes in Minimal Salt Media (MSM) after 10 days at an initial pH of 7.5 and temperature of 32 °C.

Benefit

Degradation of oil by bacteria offers environmental friendly and cost-effective to cleaning-up hydrocarbons at marine environment. The strain utilize mixtures of petroleum hydrocarbon as their carbon and energy sources to produce CO_2 and H_2O of nontoxic products.

Characteristics	*Cellulosimicrobium cellulans* (GS)
Size	Punctiform
Shape	Circular
Pigmentation	Pale-yellow
Texture	Smooth/moist
Elevation	Raised
Margin	Entire
Growth at 37°C	+
Gram Stain	+
Cell Morphology	Rod -shaped
Motility	+
Pigmentation	Pale-yellow
Catalase	+
Oxidase	+
Starch Hydrolysis	+
Gelatin hydrolysis	+
Carbohydrate Fermentation: Glucose	+
Mannitol	-
Sucrose	+
Mannose	+
Lactose	+
Maltose	+
H_2S on TSI	-
Urea production	+
Nitrate reduction	+

Table 1: Physiological and biochemical characterization of Isolated *strain Cellulosimicrobium cellulans*.

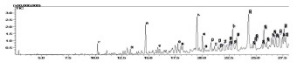

Fig 5: Total ion currents (TIC) of gas chromatography-mass spectrometer (GC-MS)

Diesel Alkanes	Carbon number	GS R_r (%)
Decane	C_{10}	10
Undecane	C_{11}	90
Dodecane	C_{12}	91.4
Tridecane	C_{13}	90.4
Tetradecane	C_{14}	24.6
Pentadecane	C_{15}	82.5
Hexadecane	C_{16}	20.3
Heptadecane	C_{17}	72
Octadecane	C_{18}	93.3
Nonadecane	C_{19}	93
Eicosane	C_{20}	17.9
Docosane	C_{22}	95.4
Tricosane	C_{23}	94.5
Tetracosane	C_{24}	11.8
Pentacosane	C_{25}	37.2
Hexacosane	C_{26}	41.3
Heptacosane	C_{27}	46.7
Octacosane	C_{28}	53.4
Nonacosane	C_{29}	71.8

Table 2: Degradation of diesel-oil alkanes by *Cellulosimicrobium cellulans*, in the MSM after 10 days at 32°C and 120 rpm.

Competitor/Market Potential

- The potential consumer of the product are a Department of Environment and non-governmental organization (NGO) to cleanup oil pollutions at marine polluted areas.
- *Cellulosimicrobium cellulans* strain can be formed in powder (freeze dry) or liquid culture, then spray on the polluted environment.
- Bioremediation offers environmental friendly and cost-effective to cleaning-up hydrocarbons at marine environment compare to chemical and physical techniques.

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CELLULOSIMICROBIUM CELLULANS CULTURE TO DEGRADE OIL POLLUTION

PATENT NO. PI2016704458

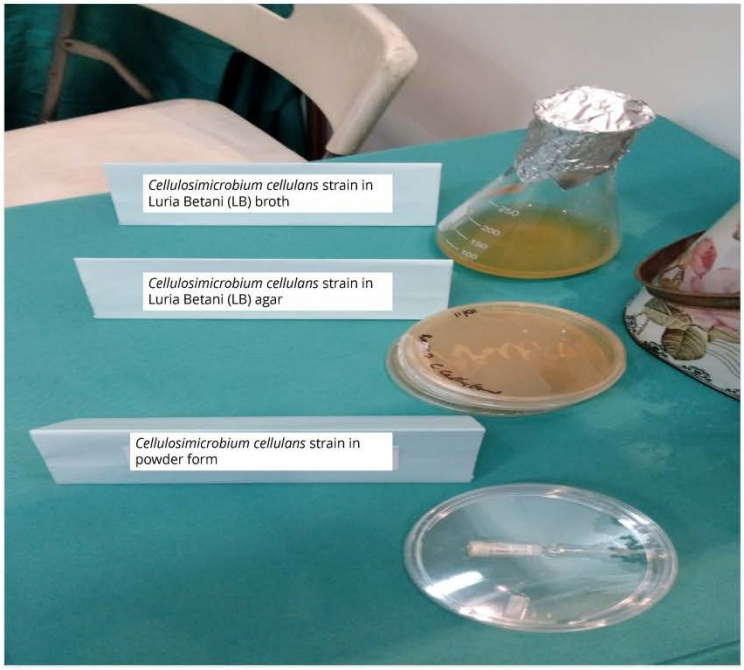

Fig 1: Tarball sample

Fig 2: Tarball sampling location at Kerteh beach Terengganu

Fig 3: Single strain of Isolated bacteria from tarball identified as *Cellulosimicrobium cellulans*

Fig 4: Phylogram showed the phylogenetic relationships of strain GS (*Cellulosimicrobium cellulans*) on 16S rRNA sequences.

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CHAPTER 6

UPM R&D EXPERTISE

UPM provides active support for collaborative R&D ventures with various industries in assisting these industries/agencies in overcoming emerging issues and problems related to technology. R&D findings will be beneficial when they are commercialised by the industries/agencies.

UPM hence encourages industries/agencies across all areas to conduct R&D collaborations with the university.

R&D as the transformation move for the nation's development.

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Institute of Advance Technology (ITMA)
Institute of Social Science Studies (IPSAS)
Malaysian Research Institute of Ageing (IPPM)
Institute for Mathematical Research (INSPEM)
Institute of Halal Products Research (IPPH)
Institute of Agricultural and Food Policy Studies (IKDPM)
Institute of Tropical Forestry and Forest Product (INTROP)
Institute of Tropical Agriculture and Food Security (ITAFOS)
Sports Academy (AS)

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